

The VLT Quality Control Loop

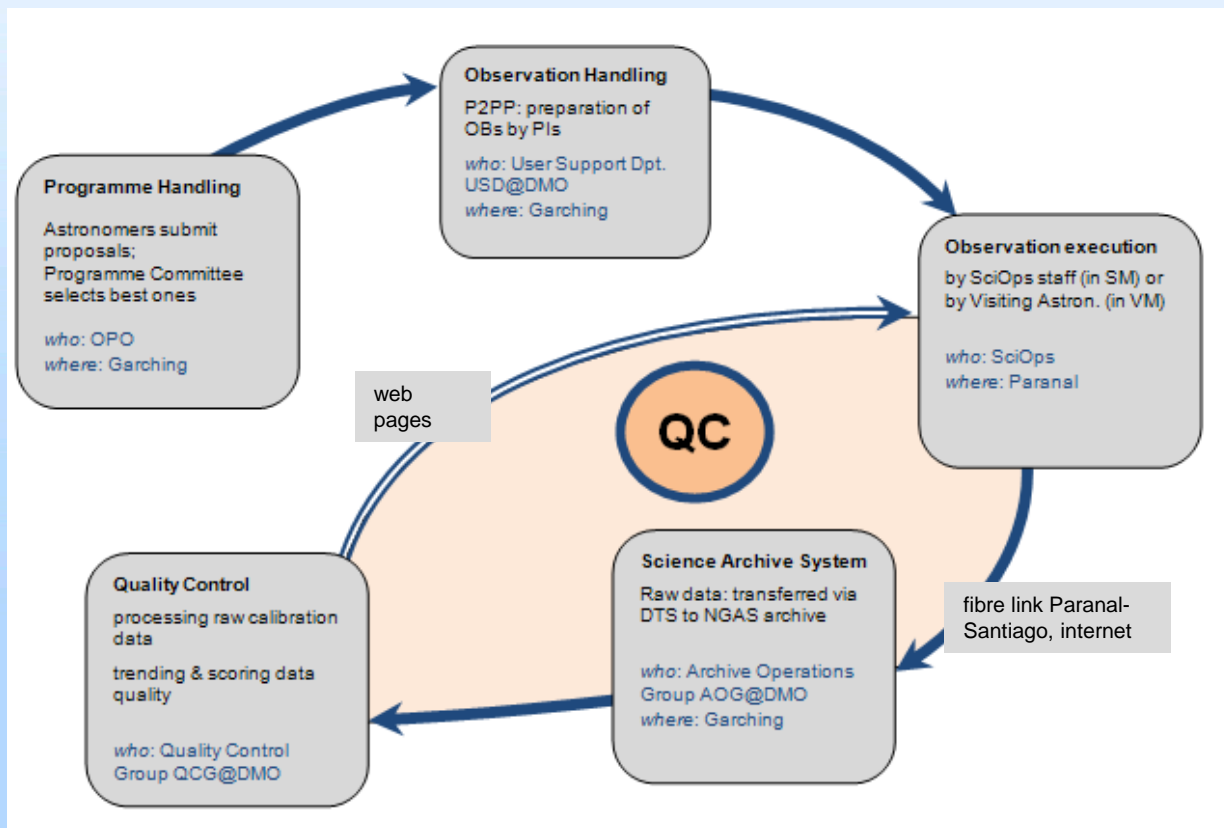
Reinhard Hanuschik,
ESO Garching



VLT data flow

- ◆ take SCIENCE & CALIBRATIONS on Paranal
- ◆ send them via data transfer system to Garching HQ
- ◆ store in archive
- ◆ QC Garching: process CALIBRATIONS
 - ◆ download new CALIBRATION data
 - ◆ pipeline-process them, do quality checks, do scores
 - ◆ provide feedback on web pages → close the QC loop
- ◆ results checked by
 - ◆ QC Garching
 - ◆ Paranal SciOps (daytime astronomers)
- ◆ same process for all VLT, VLTI, survey instruments

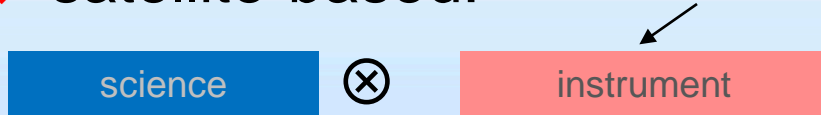
VLT data flow



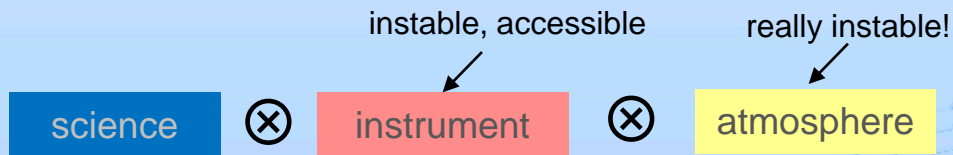
Calibrations

◆ why need CALIBs?

◆ satellite-based: stable, inaccessible



◆ ground-based: science observation



- bigger, less stable, complex
- cryogenic instruments not really accessible

- absorbing windows: can't do much (go high)
- turbulence (adaptive optics)
- standard stars (photometric, telluric, etc.)



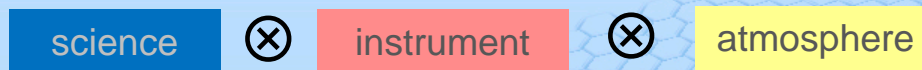
◆ → need for frequent and good calibrations

- ◆ frequency: often daily, sometimes during night

Calibrations

- ◆ VLT planned as “science data factory”:
 - ◆ any data acquisition standardized in templates and OBs
- ◆ acquired calibrations used to remove ins+atm signature from science (“reduce”)
 - ◆ using automatic pipelines

raw science observation:



calibrations:



+



reduced science observation:



Calibration strategy

- ◆ try to:
 - ◆ calibrate instrument, rather than ...
 - ◆ calibrate science data
 - ◆ works fine for imaging modes, not so good for spectral modes (too many setups)
- ◆ add maintenance and health check calibrations
- ◆ if possible, avoid precious nighttime for calibrations

Calibration strategy

Daytime calibration plan

- ◆ coded:
 - ◆ types of calibrations
 - ◆ frequency
 - ◆ setups
- ◆ two components:
 - ◆ one is triggered by science
 - ◆ one consists of long-term maintenance and health check calibs
e.g. detector or efficiency monitoring

Calibration checker

www.eso.org/CAL

◆ calChecker:

- ◆ automatic tool to monitor the calibration plan
- ◆ exists for all 15 VLT instruments (incl. VLTI, survey instr.)
- ◆ evaluation for 7 last days and all science setups
- ◆ technically: works on headers (metadata), no pipeline processing needed
- ◆ running every 30 min as cronjob

◆ controls:

- ◆ all science setups
- ◆ knows about validity and required number+types of data



Calibration completeness monitor

science data types and setups

flags ok/nok/miss

last seven days

calScores

mirror sites: [PL](#) (internal link) [HQ](#) [?](#)

all links are internal | page auto-refreshes after 300 sec | [stop](#) | [on](#) | [press Ctrl+Shift+R to enforce refresh of "ago" time information](#)

CAL | [HC](#) | [refs](#) | [QC](#)

CALCHECKER

[HOME](#) | [HELP](#)

[ALL INSTRUMENTS](#)

UT1
[CRIRES](#)
[FORS2](#)
[KMDS](#)

UT2
[FLAMES/GIRAFFE](#)
[UVES&FLAMES/UVES](#)
[X-SHOOTER](#)

UT3
[ISAAC](#)
[VIMOS](#)
[VISIR](#)

UT4
[HAWK-I](#)
[NACO](#)
[SINFONI](#)

VLTi
[AMBER](#)
[MIDI](#)

Survey Cameras
[OMEGACAM](#)
[VIRCAM](#)

QC links:
[QC home](#)
[Cal Checker](#)
[Health Checks](#)
[Reference Frames](#)

[QC1 database](#)
[Paranal autrep database \(ESO internal\)](#)

CAL GIRAFFE calChecker: calibration completeness monitor

Last update: 2013-07-03T14:40:33 (UT) (01:00h:23m ago) [?](#) Paranal date*: 2013-07-02 [?](#) server: [www.eso.org HQ](#) [HELP](#) [ASSOC-RULES](#) [DETAILS](#)

Last header: GIRAF 2013-07-03T12:38:43.592.hdr transfer ngas [?](#) *Date on this monitor changes at 21:00 UT. Current refresh frequency: 1/2hr nighttime, 1hr daytime

General news: Click "ASSOC-RULES" to view the association rules as coded along the calibration plan. Click the links in the "Data types" column for a visualization of these rules.

Long-term calibrations and maintenance [complete overview](#) | [how to execute](#) [?](#)

type of calibration	validity (days)	age (days)	evaluation
IFU2_HC_ARCLAMP	7	6.0	soft REMINDER: next 3 day(s)
IFU2_HC_FFLAMP	7	6.0	soft REMINDER: next 3 day(s)

GIRAFFE news:

[science](#) [cal4cal](#) [?](#)

[analyze ISSUES](#) | [HELP](#) | [Q&A](#) | [ASSOC-RULES](#) | [history...](#) | [contact](#) | [DataTransferMonitor](#) | [BandWidth](#)

Product availability depends on the data transfer to Garching and the archive access there (check the "transfer" and "ngas" flags above)

DATE*	2013-06-26	2013-06-27	2013-06-28	2013-06-29	2013-06-30	2013-07-01	2013-07-02	2013-07-02	action required?	Setup:
foolish science data acquired	VM 49 report NLT	VM 38 report NLT	VM 35 report NLT	VM 37 report NLT	report NLT	report NLT	report NLT	SM 2 report NLT	daytime calibs ...	[if not green: take these data types ... for these setups]
Product quality:	products	products	products	products	products	products	products	products	finished 07:52UT	
Data types:	SCIENCE_MED									
Setup:	Medusa1_H504.8_Normal									
								ok		all ok
	ok	ok								all ok
	ok	ok	ok	ok						all ok
	ok	ok	ok	ok						all ok
	ok	ok	ok	ok						all ok
	ok	ok	ok	ok						all ok
	ok	ok	ok	ok						all ok

INFORMATION SPECIFIC TO GIRAFFE [?](#)

The following keys are used to define a SCIENCE GIRAFFE setup:

ins.slit.name (= Medusa1/2; IFU1/2; Argus)
ins.exp.mode
ins1.opt1.pos (plate scale, only for Argus and only for matches with the standard star STD_ARG; POS167 or POS100)
det.read.speed ('Normal' or 'Fast', the latter being the fast readout mode offered for Argus)

The 'Product' links offer CALIB product quality information.

CONFIGURATION [?](#)

Number of days scanned:	7
Range of days for the calibration memory:	20
Days in the calibration memory:	2013-06-13 <input type="text"/>
*Date on this monitor changes at:	21:00 UT

- evaluates each box in colours:
 - **green (OK):** all calibrations complete and within validity (e.g.: 5 BIAS & 3 FLATs & 1 ARC & 1 STD, all within validity)
 - **yellow (NOK):** calibrations complete but some outdated (e.g.: as above but 3 FLATs are 2 days old instead of 1 day)
 - **red (MISS):** calibrations incomplete, at least one missing (e.g.: 5 BIAS & 3 FLATs ok, 1 STD missing)

FLATs for setup ND_30_Y8 outdated, to be taken asap

CAL HAWKI calChecker: calibration completeness monitor

Last update: 2013-07-09T13:15:42 (UT) (0d 00h:08m ago) ✓ [?] Paranal date*: 2013-07-08 [?] server: www.eso.org HQ [HELP] [ASS]

Last header: HAWKI, 2013-07-08T20:23:45.097.hdr ✓ transfer ✓ ngas [?] *Date on this monitor changes at 21:00 UT. Current refresh frequency: 1/2hr nighttime, 1hr daytime

General news: "action required" lists the datatypes which need to be taken in order to resolve the listed calChecker issues (NOK or MISS) Long-term calibrations and maintenance complete overview

type of calibration	validity (days)	age (days)	evaluation
DISTORTION_MAP	30	23.6	soft REMINI

HC analyze ISSUES HELP Q&A ASSOC-RULES history... contact DataTransferMonitor BandWidth

science cal4cal [?] Product availability depends on the data transfer to Garching and the archive access there (check the "transfer"

DATE: [?]	2013-07-02	2013-07-03	2013-07-04	2013-07-05	2013-07-06	2013-07-07	2013-07-08	2013-07-08	action required? [?]	Setup:
[color if science data acquired]				SM 75			no data	daytime calibs ...	[if not green: take these data types ...]	[? Setup: ... for these sets]
Product quality: [?]	products	products	products	products	products	products	no products	pending		

Data types:	Setup:						
SCIENCE_IMG_BROAD	ND_10.5_J_8						
	ND_30_Y_8			no			no data (yet)
	ND_9.2_Ks_8						

ANALYSIS NOTES:

Index	data type	setup	date	flag	analysis
[1]	SCIENCE_IMG_BROAD	ND_30_Y_8	2013-07-05	NOK	[please take a Y-band twilight flat (analyzed by whummel@eso.org)]

Impact of calChecker

- ◆ calibrations incomplete: science OBs to be repeated
- ◆ calChecker helps to “save last night”
- ◆ developed & maintained by QC Garching
- ◆ inspected by:
 - ◆ QC Garching (5/7 during office hours)
 - ◆ Paranal daytime crew (7 days, 24 hrs)
- ◆ both parties can provide analysis
- ◆ Paranal can launch missing calibrations

staff:
inspect red
calScores,
green ones
are auto-
checked by
the tool



The screenshot shows the 'CALCHECKER' web interface. At the top, there are navigation links for 'CAL', 'HC', 'refs', and 'QC'. Below that, there are links for 'HOME' and 'HELP', and a button for 'ALL INSTRUMENTS'. The main content is a list of instruments grouped by UT (Universal Time) zones. Each instrument name is followed by a status icon: a green square for 'OK' and a red triangle for 'Warning'.

UT	Instrument	Status
UT1	CRIRES	OK
	FORS2	OK
	KMOS	OK
UT2	FLAMES/GIRAFFE	OK
	UVES/FLAMES/UVES	Warning
	X-SHOOTER	OK
UT3	ISAAC	OK
	VIMOS	Warning
	VISIR	OK
UT4	HAWK-I	Warning
	NACO	OK
	SINFONI	OK
VLT	AMBER	OK
	MIDI	OK
	Survey Cameras	
	OMEGACAM	Warning
	VIRCAM	OK

QC links:

Calibration quality

- ◆ so far: calibration completeness
 - ◆ but: an overexposed flat-field calibration, or a badly pointed STD star is useless & does not calibrate
 - ◆ hence: checking calibration quality second important QC job
- Health Check (HC) monitor

HC monitor

www.eso.org/HC

- ◆ automatic pipeline processing of CALIBs
 - ◆ incremental by QC Garching: 1x per hour
 - ◆ all calibrations

- ◆ after processing:
 - ◆ extract QC “level-1” parameters
 - ◆ calculate quality scores

- ◆ for most important instrument components: put results on HC monitor page

VIMOS trending system: HEALTH CHECK report

Last update: 2013-07-04T03:30:16 (UT) (0d 07h:02m ago) | now: 2013-07-04T10:32:37 (UT) | QC pipeline: vimos2.9.7 (installed 2013-04-23)

same group: median_master ron_master rms_master ron_raw median_vs_temp averages_low averages_high

General news: Click 'scores&comments' to switch to score details, and 'HC plot' to switch back to the graphics.

VIMOS news:

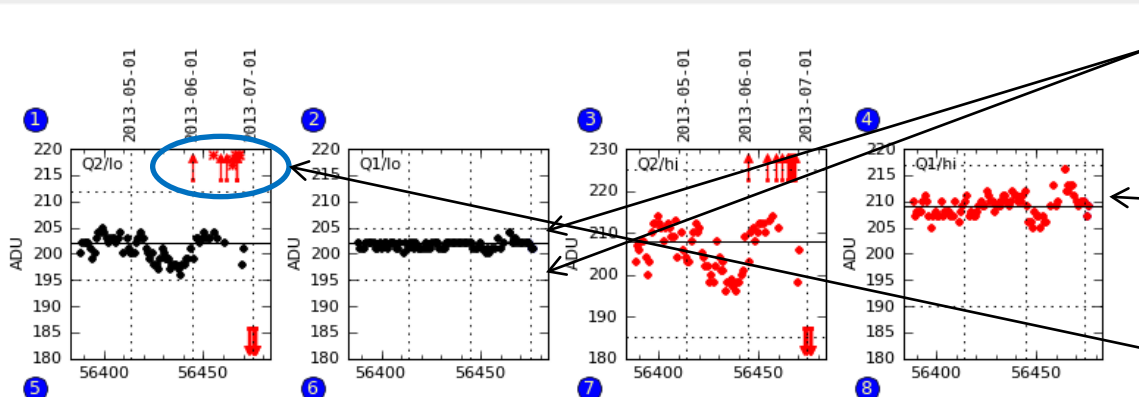
Report news: 2013-07-01 again jump in bias level in Q2, please check [qc_vimos@eso.org]

DATE: [?]	2013-06-27	2013-06-28	2013-06-29	2013-06-30	2013-07-01	2013-07-02	2013-07-03	last OPSLOG data:	monitor
	report NLT	report NLT	report NLT	report NLT	report NLT	report NLT	report NLT	2013-07-02'	✓ ftp
P... Product quality:	products	products	products	products	products	products	products	last files ...	✓ parser

scores&comments | history ... | plot tutorial ... | contact | daily/often; important to check | *Date on this monitor changes at 21:00 UT

VIMOS: median BIAS level (last 90 days)

QC data range: 2013-04-06 ... 2013-07-02*



thresholds

outliers

- ◆ QC parameters like **median_master**, **rms_fit**, **zeropoint**
- ◆ trending plots of last 3 months: check data in context
- ◆ define thresholds and outliers

Scores

- ◆ concept for information reduction (reduction of complexity)
- ◆ As long as data points fall inside configured thresholds, they are ok
- ◆ for compliance, only OK or NOK important: *scores*
- ◆ scores:
 - ◆ important concept for reducing information (many dozen HC plots)
 - ◆ goal: significant alerts (no false greens, no false reds)
- ◆ HC plots come in two versions:
 - ◆ plot
 - ◆ quick-look scores

CAL | HC | refs | QC

HealthCheck Monitor

HOME | UsersGuide

ALL INSTRUMENTS

VIMOS:

- score overview
- Common ...
- detector: bias
- detector: monitoring
- lamp stability
- focus
- Imaging ...
- IMG filter performance
- IMG astrometry
- IMG zeropoints
- IMG sky flat structure
- MOS ...
- MDS dispersion
- MDS resolution
- MDS efficiency
- MDS mask to CCD
- IFU ...
- IFU dispersion
- IFU stability
- IFU slope
- IFU resolution
- IFU lost fibres
- IFU efficiency
- HISTORICAL ...
- image quality science
- QC VIMOS
- Other HC:
- UT1
- CPDCC

[page auto-refreshes after 300 sec] [stop] [on] [press Ctrl+Shift+R to enforce refresh of scores, dates and news]

VIMOS trending system: HEALTH CHECK report

HELP USERS-GUIDE MORE

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General news: Click 'scores&comments' to switch to score details, and 'HC plot' to switch back to the graphics.

VIMOS news:

Report news: [edit](#) 2013-07-01 again jump in bias level in Q2, please check [qc_vimos@eso.org]

DATE:	2013-06-27	2013-06-28	2013-06-29	2013-06-30	2013-07-01	2013-07-02	2013-07-03	last OPSLOG data:	monitor
	report NLT	report NLT	report NLT	report NLT	report NLT	report NLT	report NLT	2013-07-02'	<input checked="" type="checkbox"/> ftp
P...	Product quality: products	products	products	products	products	products	products	last files ...	<input checked="" type="checkbox"/> parser

[scores&comments](#) | [history...](#) | [plot tutorial...](#) | [contact](#)

 daily/often; important to check [?]

*Date on this monitor changes at 21:00 UT

VIMOS: median BIAS level (last 90 days)

QC data range: 2013-04-06 ... 2013-07-02*

full version:
trending plot,
VIMOS BIAS stability



CAL | HC | refs | QC

HealthCheck Monitor

HOME | UsersGuide

ALL INSTRUMENTS

VIMOS:

- score overview
- Common ...
- detector: bias
- detector: monitoring
- lamp stability
- focus
- Imaging ...
- IMG filter performance
- IMG astrometry
- IMG zeropoints
- IMG sky flat structure
- MOS ...
- MDS dispersion
- MDS resolution
- MDS efficiency
- MDS mask to CCD

[page auto-refreshes after 300 sec] [stop] [on] [press Ctrl+Shift+R to enforce refresh of scores, dates and news]

VIMOS trending system: SCORES (quick-look)

HELP USERS-GUIDE MORE

Last update: 2013-07-04T03:30:16 (UT) (0d 07h:04m ago) | now: 2013-07-04T10:32:33 (UT) | QC pipeline: vimos-2.9.7 (installed 2013-04-23)

same group: median_master ron_master rms_master ron_raw median_vs_temp averages_low averages_high

General news: Click 'scores&comments' to switch to score details, and 'HC plot' to switch back to the graphics.

VIMOS news:

Report news: [edit](#) 2013-07-01 again jump in bias level in Q2, please check [qc_vimos@eso.org]

DATE:	2013-06-27	2013-06-28	2013-06-29	2013-06-30	2013-07-01	2013-07-02	2013-07-03	last OPSLOG data:	monitor
	report NLT	report NLT	report NLT	report NLT	report NLT	report NLT	report NLT	2013-07-02'	<input checked="" type="checkbox"/> ftp
P...	Product quality: products	products	products	products	products	products	products	last files ...	<input checked="" type="checkbox"/> parser

[HC plot](#) | [history...](#) | [plot tutorial...](#) | [contact](#)

 daily/often; important to check [?]

*Date on this monitor changes at 21:00 UT

median BIAS level (scores, last 7 days up to 2013-07-02')

1: Q2/lo	2: Q1/lo	3: Q2/hi	4: Q1/hi
▲ 6 ▲▲▲▲▲	■ 7 ●●●●●	▲ 6 ▲▲▲▲▲	■ 7 ●●●●●
5: Q3/lo	6: Q4/lo	7: Q3/hi	8: Q4/hi
■ 7 ●●●●●	■ 7 ●●●●●	■ 7 ●●●●●	■ 7 ●●●●●

same report, score version
(quick-look)



- big advantage of score hierarchies:
 - instrument score green → you know **within a second**: all is OK!
 - if red: the score overview can tell you more

CAL | HC | refs | QC

HealthCheck Monitor

HOME | UsersGuide

ALL INSTRUMENTS

FORS2:

score overview ■

detector: bias ■

detector: monitoring ■

LSS: wavelength calibration ■

MOS: wavelength calibration ■

polarization optics ■

screen flats ■

lamps: arcs+flats ■

IMG zeropoints ■

extinction ■

extinction monitor ■

spec. efficiency ■

EEV CCD (Visitor Mode only)

detector: bias ■

detector: monitoring ■

spec. efficiency ■

HISTORICAL:

Old CCD (until 2002-04)

detector: bias ■

detector: dark ■

UBV filters (until 2008-04)

FORS2 trending system: overview o

Last update: 2013-07-04T15:36:28 (UT)

General news: [Click 'scores&comments' to switch to score details, and 'HC plot' to switch](#)

FORS2 news:

FORS2 instrument score: ■ [red score comments ...](#) | [all comments ...](#) [edit COM](#)

HC navigation group	group score	report scores		
detector:_bias	■	med master ■	ron raw ■	ron mas ■
detector:_monitoring	■	dark ■	linearity ■	ga ■
LSS:_wavelength_calibration	■	lambda_c ■	resolution ■	nwa ■
MOS:_wavelength_calibration	■	lambda_c ■	resolution ■	nwa ■
polarization_optics	■	angle_offset ■	pol_offset ■	instr_r ■
screen_flats	■	SCR_FF_RI ■	SCR_FF_uv ■	SCR_FF ■
lamps:_arcs+flats	■	FFB12 ■	FFB34 ■	FFR ■
IMG_zeropoints	■	b_HIGH ■	y_HIGH ■	R_SPE ■
extinction	■	b_HIGH,y_HIGH ■	R_SPEC,I_BESS ■	■
extinction_monitor	■	b_HIGH,y_HIGH ■	R_SPEC,I_BESS ■	■
spec._efficiency	■	150I ■	300V ■	3I ■
detector:_bias	■	med master ■	ron raw ■	ron mas ■
detector:_monitoring	■	dark ■	linearity ■	ga ■
spec._efficiency	■	300V ■	600B,1200B ■	■
detector:_bias	■	<i>no scoring</i>		
detector:_dark	■	<i>no scoring</i>		
IMG_zeropoints:_frame	■	<i>no scoring</i>		
image_quality_science	■	<i>no scoring</i>		

Impact of HC monitor

- ◆ red score issue discovered during daytime:
 - ◆ chance to fix before next night begins
- ◆ HC monitor helps to “save next night”
- ◆ developed & maintained by QC Garching
- ◆ inspected by Paranal and QC Garching
- ◆ both parties can provide analysis
- ◆ Paranal can interpret and take actions

Who benefits?

◆ VLT/Paranal SciOps

- ◆ HC monitor: recognize instrumental problems
- ◆ ensure the commitment to deliver best possible science
- ◆ long-term: preventive maintenance
- ◆ plan instrument upgrades (e.g. detector performance)

◆ Science PIs

- ◆ save science observations by CALIB completeness & quality

◆ Archive science

- ◆ provide quality-certified calibrations (the ones with all scores green)
- ◆ science & calibrations: long-term asset (→ poster PHOENIX!)

Summary

- ◆ with data transfer link Paranal-Garching, data acquisition is done on Paranal and data checks in Garching
- ◆ calibration data are checked by tools and humans
- ◆ focus on two aspects:
 - ◆ calibration completeness
 - ◆ calibration quality
- ◆ QC loop is automated, running 24/7
- ◆ scheme is based on information distillation: scores
- ◆ goal is to provide significant scores (most of the time the system should be green rather than red)